DOCUMENT RESUME

ED 334 391 CE 058 406

TITLE Standardized Curriculum for Heating and Air Conditioning.
INSTITUTION Mississippi State Dept. of Education, Jackson. Office of Vocational, Technical and Adult Education.
PUB DATE Jun 89
NOTE 58p.; For related documents, see CE 058 387-419.
PUB TYPE Guides - Classroom Use - Teaching Guides (For Teacher) (052)

EDRS PRICE MF01/PC03 Plus Postage.
DESCRIPTORS *Air Conditioning; Behavioral Objectives; Check Lists; Competency Based Education; *Core Curriculum; Electric Circuits; *Heating; Measurement Equipment; Occupational Safety and Health; Refrigeration; Refrigeration Mechanics; Secondary Education; State Curriculum Guides; *State Standards; Student Evaluation
IDENTIFIERS Mississippi

ABSTRACT

Standardized vocational education course titles and core contents for two courses in Mississippi are provided: heating and air conditioning I and II. The first course contains the following units: (1) orientation; (2) safety; (3) refrigeration gauges and charging cylinder; (4) vacuum pump service operations; (5) locating refrigerant leaks; (6) copper tubing; (7) soft soldering procedures; (8) silver brazing; and (9) meters. The second course contains the following units: (1) orientation; (2) safety; (3) electric circuits and controls, part 1; (4) electric circuits and controls, part 2; (5) domestic refrigeration and freezers; (6) commercial systems; (7) commercial condensers; (8) commercial evaporators, part 1; (9) commercial evaporators, part 2; and (10) commercial motor controls. Each unit consists of these components: objectives, with core/essential objectives indicated; suggested instructional practices; list of suggested resources; list of evaluation and suggested minimum performance standards, with core/essential objectives indicated; and performance record, with core/essential objectives indicated. A checklist for each course combining all unit performance standards into a single list is included. (NLA)

****
* Reproductions supplied by EDRS are the best that can be made *
* from the original document. *
****

U.S. DEPARTMENT OF EDUCATION
Office of Educational Research and Improvement
EDUCATIONAL RESOURCES INFORMATION CENTER (ERIC)

☑ This document has been reproduced as received from the person or organization originating it.

☐ Minor changes have been made to improve reproduction quality.

• Points of view or opinions stated in this document do not necessarily represent official OERI position or policy.

"PERMISSION TO REPRODUCE THIS MATERIAL HAS BEEN GRANTED BY

TO THE EDUCATIONAL RESOURCES INFORMATION CENTER (ERIC)."

BEST COPY AVAILABLE

STANDARDIZED CURRICULUM

FOR

HEATING AND AIR CONDITIONING

MISSISSIPPI DEPARTMENT OF EDUCATION

OFFICE OF VOCATIONAL, TECHNICAL

AND ADULT EDUCATION

June 1989

Direct inquiries to:

Thomas Piazza, Supervisor
Trade and Engineering Technology
Office of Vocational, Technical and Adult Education
P.O. Box 771
Jackson, Mississippi 39205
Phone: (601) 359-3937

Published by the:

Office of Vocational, Technical and Adult Education
Mississippi State Department of Education
Jackson, Mississippi

and

Research and Curriculum Unit for Vocational, Technical and Adult Education
College of Education
Mississippi State University
Mississippi State, Mississippi

1989

The State of Mississippi is an equal opportunity employer and does not discriminate or deny service on the basis of race, color, and national origin, sex, handicap, and/or age.

FOREWORD

This volume is intended to be used in the State of Mississippi as a mechanism for standardizing vocational education course titles and core contents. The need for standardization of curricula was triggered by provisions in the Educational Reform Act of 1982 which mandated:

-- elimination of nearly all currently existing curriculum requirements and development of new curriculum content that is "properly sequenced" and "coordinated";

-- steps to ensure that students master one level of course work before being advanced to the next level and that progression is properly sequenced;

-- a criterion-referenced, state-wide testing program that is built upon an identified set of "basic skills" keyed to student performance in grades 3, 5, 8, and 11;

-- revised graduation requirements that take into account student performance on the basic skills and also on a test of "functional literacy skills"; and

-- a system of accrediting schools that takes into account the performance of districts, schools, and students.

In addition to the mandates of the Educational Reform Act, the Strategic Plan for Vocational and Technical Education in Mississippi also calls for improving the quality of vocational and technical education through the standardization of curricula and the articulation of secondary and postsecondary programs.

Both of these mandates were further reinforced by legislation passed in 1986 which called for the establishment of state-wide "guidelines and procedures for managing an instructional program in the public schools." This legislation calls for instructional management plans containing the following components:

1. a written list of learning objectives for every course for which academic credit is given on students' transcripts (state specified core objectives must be included);

2. <u>suggested</u> instructional practices and resources for the learning objectives;

3. standards for student performance for each learning objective; and

4. systematic procedures for evaluating student performance on the learning objectives.

Specific local district actions regarding the state-wide instructional management plan are also required, namely:

1. The objectives contained in this document are common to all programs in the state. Core objectives are designated with an asterisk. The local district is encouraged to add additional objectives to this listing to meet local needs of students and employers.

2. The local school board must officially adopt the learning objectives as the district's curricula.

3. Pass/fail policies must be based on mastery of learning objectives.

4. Student performance on the learning objectives must be systematically evaluated at least once during the school year.

5. During the school year, records of individual student performance must indicate whether or not the objectives have been mastered. The record must indicate mastery status for each of the objectives tested in the Basic Skills Assessment Program (including functional literacy skills) and must be permanently maintained on all students who do <u>not</u> master the basic and functional literacy skills prior to being tested on them.

6. Each year, information about student performance on learning objectives must be reviewed. Those objectives which students are not mastering must be identified, and a plan must be developed for improving student performance on those objectives.

TABLE OF CONTENTS

Page

HEATING AND AIR CONDITIONING I..... 1

HEATING AND AIR CONDITIONING II..... 21

STUDENT PERFORMANCE RECORD..... 45

HEATING AND AIR CONDITIONING I

Developed by

Harvey Warrington, Kosciusko-Attala County Vocational Center
Thomas Tourne', Canton Vocational Center
Donnie Wigginton, Tishomingo County Vocational Center
Stephen Buckheister, Jackson County Vocational Center

HEATING AND AIR CONDITIONING I

Unit No.	Title
1	Orientation
2	Safety
3	Refrigeration Gauges and Charging Cylinder
4	Vacuum Pump Service Operations
6	Locating Refrigerant Leaks
7	Copper Tubing
8	Soft Soldering Procedures
9	Silver Brazing
10	Meters

COURSE: Heating and Air Conditioning I

Unit 1: Orientation

Objectives: Upon completion of this unit, the student will:

*1. Identify school policy relating to students.
*2. Identify class rules relating to students.
3. List advantages of participating in VICA.
4. Describe the history and development of air conditioning and refrigeration.
*5. List jobs available in the heating and air conditioning field.
*6. Define terms related to heating and air conditioning.

*Indicates core/essential objectives

Suggested Instructional Procedures:

Lecture - discussion

Suggested Resources:

Primary Source: Wantiez, G.W. Air Conditioning and Refrigeration Fundamentals. Stillwater, OK: Mid-America Vocational Consortium. 1984.

Secondary Source: Andrew, D.A., Turquist, C.H., and Bracciano, A.F. Modern Refrigeration and Air Conditioning. South Holland, IL: The Goodheart-Willcox Company, Inc. 1982.

Evaluation and Suggested Minimum Performance Standards:

*Objective 1: The student will identify school policy relating to students.
*Objective 2: The student will identify class rules relating to students.
Objective 3: The student will list five advantages of participating in VICA.
Objective 4: The student will describe the history and development of air conditioning and refrigeration.
*Objective 5: The student will list four jobs available in the heating and air conditioning field.
*Objective 6: The student will define twenty terms related to heating and air conditioning.

*Indicates core/essential objectives

Performance Record: Place a check by each objective the student achieved:

____*1. Identified school policy relating to students.
____*2. Identified class rules relating to students.
____ 3. Listed advantages of participating in VICA.
____ 4. Described the history and development of air conditioning and refrigeration.
____*5. Listed jobs available in the heating and air conditioning field.
____*6. Defined terms related to heating and air conditioning.

*Indicates core/essential objectives

COURSE: Heating and Air Conditioning I

Unit 2: Safety

Objectives: Upon completion of this unit, the student will:

*1. List ways of protecting eyes while in the shop.
2. Name characteristics of a clean shop.
*3. List rules of general shop safety.
*4. Describe types of fires.
*5. List steps to follow in case of an accident in the shop.
*6. Explain proper method of lifting heavy objects.
*7. Identify components of the fire triangle.
*8. List safety rules to follow when using an acetylene and oxyacetylene torch.
9. List dangers related to using refrigerants.

*Indicates core/essential objectives

Suggested Instructional Procedures:

Lecture - discussion

Suggested Resources:

Primary Source: Wantiez, G.W. Air Conditioning and Refrigeration Fundamentals. Stillwater, OK: Mid-America Vocational Consortium. 1984.

Secondary Source: Andrew, D.A., Turnquist, C.H., and Bracciano, A.F. Modern Refrigeration and Air Conditioning. South Holland, IL: The Goodheart-Willcox Company, Inc. 1982.

Evaluation and Suggested Minimum Performance Standards:

*Objective 1: The student will list two ways of protecting eyes while in the shop.
Objective 2: The student will name five characteristics of a clean shop.
*Objective 3: The student will list six rules of general shop safety.
*Objective 4: The student will describe three types of fires.
*Objective 5: The student will list five steps to follow in case of an accident in the shop.
*Objective 6: The student will explain proper method of lifting heavy objects.

*Objective 7: The student will identify three components of the fire triangle.

*Objective 8: The student will list four safety rules to follow when using an acetylene and oxyacetylene torch.

Objective 9: The student will list four dangers related to using refrigerant.

*Indicates core/essential objectives

Performance Record: Place a check by each objective the student achieved:

____*1. Listed ways of protecting eyes while in the shop.
____ 2. Named characteristics of a clean shop.
____*3. Listed rules of general shop safety.
____*4. Described types of fires.
____*5. Listed steps to follow in case of an accident in the shop.
____*6. Explained proper method of lifting heavy objects.
____*7. Identified components of the fire triangle.
____*8. Listed safety rules to follow when using an acetylene and oxyacetylene torch.
____ 9. Listed dangers related to using refrigerant.

*Indicates core/essential objectives

COURSE: Heating and Air Conditioning I

Unit 3: Refrigeration Gauges and Charging Cylinder

Objectives: Upon completion of this unit, the student will:

*1. State the purpose of a compound gauge.
2. State the most common cause of a gauge losing calibration.
*3. State the purpose of a pressure gauge.
4. List types of pressure gauges.
*5. Calibrate a gauge according to industry standards.
*6. State the main reason for using torque wrenches when installing gauges.
7. List fittings to be used when connecting a compound gauge with 1/8 inch pipe male thread to a service valve having 1/4 inch female thread.
*8. Charge the system from the low side according to industry standards.
*9. List steps to follow when charging the system through the high side using a charging cylinder.

*Indicates core/essential objectives

Suggested Instructional Procedures:

Lecture - discussion
Laboratory participation

Suggested Resources:

Primary Source: Andrew, D.A., Turnquist, C.H., and Bracciano, A.F. Modern Refrigeration and Air Conditioning. South Holland, IL: The Goodheart-Willcox Company, Inc. 1982.

Secondary Source: Wantiez, G.W. Air Conditioning and Refrigeration Fundamentals. Stillwater, OK: Mid-America Vocational Consortium. 1984.

Evaluation and Suggested Minimum Performance Standards:

*Objective 1: The student will state the purpose of a compound gauge.
Objective 2: The student will state the most common cause of a gauge losing calibration.
*Objective 3: The student will state the purpose of a pressure gauge.

Objective 4: The student will list three types of pressure gauges.
*Objective 5: The student will calibrate a gauge according to industry standards.
*Objective 6: The student will state the main reason for using torque wrenches when installing gauges.
Objective 7: The student will list three fittings to be used when connecting a compound gauge with 1/8 inch pipe male thread to a service valve having 1/4 inch female thread.
*Objective 8: The student will charge the system from the low side according to industry standards.
*Objective 9: The student will list four steps to follow when charging the system through the high side using a charging cylinder.

*Indicates core/essential objectives

Performance Record: Place a check by each objective the student achieved:

____*1. Stated the purpose of a compound gauge.
____ 2. Stated the most common cause of a gauge losing calibration.
____*3. Stated the purpose of a pressure gauge.
____ 4. Listed types of pressure gauges.
____*5. Calibrated a gauge.
____*6. Stated the main reason for using torque wrenches when installing gauges.
____ 7. Listed fittings to be used when connecting a compound gauge with 1/8 inch pipe male thread to a service valve having 1/4 inch female thread.
____*8. Charged the system from the low side according to industry standards.
____*9. Listed steps to follow when charging the system through the high side using a charging cylinder.

*Indicates core/essential objectives

COURSE: Heating and Air Conditioning I

Unit 4: Vacuum Pump Service Operations

Objectives: Upon completion of this unit, the student will:

*1. List steps to follow when removing refrigerant from the system.
2. Name special access fittings needed for the removal of a refrigerant for the system.
*3. Install a vacuum pump on a system in order to pump it down.
4. Demonstrate steps to follow when purging and cleaning a system which had an electrical burnout.
*5. Describe the effect of freon and fluorocarbons on the atmosphere.
*6. Demonstrate the proper extraction and disposal of freon from a refrigeration unit.

*Indicates core/essential objectives

Suggested Instructional Procedures:

Lecture - discussion
Laboratory participation

Suggested Resources:

Primary Source: Andrew, D.A., Turnquist, C.H., and Bracciano, A.F. Modern Refrigeration and Air Conditioning. South Holland, IL: The Goodheart-Willcox Company, Inc. 1982.

Secondary Source: Wantiez, G.W. Air Conditioning and Refrigeration Fundamentals. Stillwater, OK: Mid-America Vocational Consortium. 1984.

Evaluation and Suggested Minimum Performance Standards:

*Objective 1: The student will list six steps to follow when removing refrigerant from the system.
Objective 2: The student will name three special access fittings needed for the removal of a refrigerant for the system.
*Objective 3: The student will install a vacuum pump on a system, according to industry standards, in order to pump it down.
Objective 4: The student will demonstrate the steps to follow when purging and cleaning a system which had an electrical burnout.

*Objective 5: The student will describe the effect of freon and fluorocarbons on the atmosphere.

*Objective 6: The student will demonstrate the proper extraction and disposal of freon from a refrigeration unit.

*Indicates core/essential objectives

Performance Record: Place a check by each objective the student achieved:

____*1. Listed steps to follow when removing refrigerant from the system.

____ 2. Named special access fittings needed for the removal of a refrigerant for the system.

____*3. Installed a vacuum pump on a system in order to pump it down.

____ 4. Demonstrated steps to follow when purging and cleaning a system which had an electrical burnout.

____*5. Described the effect of freon and fluorocarbons on the atmosphere.

____*6. Demonstrated the proper extraction and disposal of freon from a refrigeration unit.

*Indicates core/essential objectives

COURSE: Heating and Air Conditioning I

Unit 5: Locating Refrigerant Leaks

Objectives: Upon completion of this unit, the student will:

*1. List types of refrigerant leak detectors.
2. Demonstrate using soap bubbles as a detector.
*3. Describe the procedure for using an electronic refrigerant detector.
*4. List advantages of soap bubbles.
5. List disadvantages of soap bubbles.
*6. List advantages of an electronic detector.
7. List disadvantages of an electronic detector.
*8. List advantages of a gas detector.
*9. List disadvantages of a gas detector.

*Indicates core/essential objectives

Suggested Instructional Procedures:

Lecture - discussion
Laboratory participation

Suggested Resources:

Primary Source: Andrew, D.A., Turnquist, C.H., and Bracciano, A.F. Modern Refrigeration and Air Conditioning. South Holland, IL: The Goodheart-Willcox Company, Inc. 1982.

Secondary Source: Wantiez, G.W. Air Conditioning and Refrigeration Fundamentals. Stillwater, OK: Mid-America Vocational Consortium. 1984.

Miller, R. Refrigeration and Air Conditioning Technology. Peoria, IL: Bennett & McKnight Publishing Company. 1983.

Evaluation and Suggested Minimum Performance Standards:

*Objective 1: The student will list three types of refrigerant leak detectors.
Objective 2: The student will demonstrate the procedure for using soap bubbles as a detector.
*Objective 3: The student will describe the procedure for using an electronic refrigerant detector.

*Objective 4: The student will list four advantages of soap bubbles.
Objective 5: The student will list two disadvantages of soap bubbles.
*Objective 6: The student will list three advantages of an electronic detector.
Objective 7: The student will list two disadvantages of an electronic detector.
*Objective 8: The student will list two advantages of a gas detector.
*Objective 9: The student will list two disadvantages of a gas detector.

*Indicates core/essential objectives

Performance Record: Place a check by each objective the student achieved:

____*1. Listed types of refrigerant leak detectors.
____ 2. Demonstrated using soap bubbles as a detector.
____*3. Described the procedure for using an electronic refrigerant detector.
____*4. Listed advantages of soap bubbles.
____ 5. Listed disadvantages of soap bubbles.
____*6. Listed advantages of an electronic detector.
____ 7. Listed disadvantages of an electronic detector.
____*8. Listed advantages of a gas detector.
____*9. Listed disadvantages of a gas detector.

*Indicates core/essential objectives

COURSE: Heating and Air Conditioning I

Unit 6: Copper Tubing

Objectives: Upon completion of this unit, the student will:

*1. Name types of tubing.
2. List sizes of copper tubing.
*3. Identify tools needed to flare copper tubing.
*4. Name tools used to cut copper tubing.
5. Bend copper tubing.
*6. Swage copper tubing.

*Indicates core/essential objectives

Suggested Instructional Procedures:

Lecture - discussion
Laboratory participation

Suggested Resources:

Primary Source: Andrew, D.A., Turnquist, C.H., and Bracciano, A.F. Modern Refrigeration and Air Conditioning. South Holland, IL: The Goodheart-Willcox Company, Inc. 1982.

Secondary Source: Wantiez, G.W. Air Conditioning and Refrigeration Fundamentals. Stillwater, OK: Mid-America Vocational Consortium. 1984.

Evaluation and Suggested Minimum Performance Standards:

*Objective 1: The student will name two types of tubing.
Objective 2: The student will list three sizes of copper tubing.
*Objective 3: The student will identify four tools needed to flare copper tubing.
*Objective 4: The student will name two tools used to cut copper tubing.
Objective 5: The student will bend copper tubing according to industry standards.
*Objective 6: The student will swage copper tubing according to industry standards.

*Indicates core/essential objectives

Performance Record: Place a check by each objective the student achieved:

____*1. Named types of tubing.
____ 2. Listed sizes of copper tubing.
____*3. Identified tools needed to flare copper tubing.
____*4. Named tools used to cut copper tubing.
____ 5. Bent copper tubing.
____*6. Swaged copper tubing.

*Indicates core/essential objectives

COURSE: Heating and Air Conditioning I

Unit 7: Soft Soldering Procedures

Objectives: Upon completion of this unit, the student will:

*1. Demonstrate safety rules to observe when using an acetylene torch.
*2. Name the steps to follow when lighting an acetylene torch.
3. Name types of flux used when soldering with an acetylene torch.
*4. Solder two pieces of copper tubing together.

*Indicates core/essential objectives

Suggested Instructional Procedures:

Lecture - discussion
Laboratory participation

Suggested Resources:

Primary Source: Andrew, D.A., Turnquist, C.H., and Bracciano, A.F. Modern Refrigeration and Air Conditioning. South Holland, IL: The Goodheart-Willcox Company, Inc. 1982.

Secondary Source: Wantiez, G.W. Air Conditioning and Refrigeration Fundamentals. Stillwater, OK: Mid-America Vocational Consortium. 1984.

Evaluation and Suggested Minimum Performance Standards:

*Objective 1: The student will demonstrate safety rules to observe when using an acetylene torch.
*Objective 2: The student will name the steps to follow when lighting an acetylene torch.
Objective 3: The student will name two types of flux used when soldering with an acetylene torch.
*Objective 4: The student will solder two pieces of copper tubing together according to industry standards.

*Indicates core/essential objectives

Performance Record: Place a check by each objective the student achieved:

____*1. Demonstrated safety rules to observe when using an acetylene torch.
____*2. Named the steps to follow when lighting an acetylene torch.
____ 3. Named types of flux used when soldering with an acetylene torch.
____*4. Soldered two pieces of copper tubing together.

*Indicates core/essential objectives

COURSE: Heating and Air Conditioning I

Unit 8: Silver Brazing

Objectives: Upon completion of this unit, the student will:

*1. Demonstrate safety rules to observe when using an acetylene torch.
*2. Turn off an acetylene torch.
*3. Clean copper tubing for silver soldering.
*4. Describe the proper appearance of the torch flame when it is ready for use.
5. Silver braze two pieces of copper tubing together.

*Indicates core/essential objectives

Suggested Instructional Procedures:

Lecture - discussion
Laboratory participation

Suggested Resources:

Primary Source: Andrew, D.A., Turnquist, C.H., and Bracciano, A.F. Modern Refrigeration and Air Conditioning. South Holland, IL: The Goodheart-Willcox Company, Inc. 1982.

Secondary Source: Wantiez, G.W. Air Conditioning and Refrigeration Fundamentals. Stillwater, OK: Mid-America Vocational Consortium. 1984.

Evaluation and Suggested Minimum Performance Standards:

*Objective 1: The student will demonstrate safety rules to observe when using an acetylene torch.
*Objective 2: The student will turn off an acetylene torch according to instructor's specifications.
*Objective 3: The student will clean copper tubing for silver soldering according to industry standards.
*Objective 4: The student will describe the proper appearance of the torch flame when it is ready for use.
Objective 5: The student will silver braze two pieces of copper tubing together.

*Indicates core/essential objectives

Performance Record: Place a check by each objective the student achieved:

____*1. Demonstrated safety rules to observe when using an acetylene torch.
____*2. Turned off an acetylene torch.
____*3. Cleaned copper tubing for silver soldering.
____*4. Described the proper appearance of the torch flame when it is ready for use.
____ 5. Silver brazed two pieces of copper tubing together.

*Indicates core/essential objectives

COURSE: Heating and Air Conditioning I

Unit 9: Meters

Objectives: Upon completion of this unit, the student will:

*1. List voltage readings of meters.
2. Name scales found on an ohm meter.
3. Name scales found on an amp meter.
*4. Describe the functions of an ohm meter.
*5. Describe the functions of an amp meter.
*6. Take a reading with an ohm meter.
*7. Take a reading with an amp meter.
*8. Take a reading with a volt meter.

*Indicates core/essential objectives

Suggested Instructional Procedures:

Lecture - discussion

Suggested Resources:

Primary Source: Andrew, D.A., Turnquist, C.H., and Bracciano, A.F. Modern Refrigeration and Air Conditioning. South Holland, IL: The Goodheart-Willcox Company, Inc. 1982.

Secondary Source: Wantiez, G.W. Air Conditioning and Refrigeration Fundamentals. Stillwater, OK: Mid-America Vocational Consortium. 1984.

Evaluation and Suggested Minimum Performance Standards:

*Objective 1: The student will list two voltage readings of meters.
Objective 2: The student will name three scales found on an ohm meter.
Objective 3: The student will name two scales found on an amp meter.
*Objective 4: The student will describe the functions of an ohm meter.
*Objective 5: The student will describe the functions of an amp meter.
*Objective 6: The student will take an accurate reading with an ohm meter.
*Objective 7: The student will take an accurate reading with an amp meter.

*Objective 8: The student will take an accurate reading with a volt meter.

*Indicates core/essential objectives

Performance Record: Place a check by each objective the student achieved:

____*1. Listed voltage readings of meters.
____ 2. Named scales found on an ohm meter.
____ 3. Named scales found on an amp meter.
____*4. Described the functions of an ohm meter.
____*5. Described the functions of an amp meter.
____*6. Took a reading with an ohm meter.
____*7. Took a reading with an amp meter.
____*8. Took a reading with a volt meter.

*Indicates core/essential objectives

HEATING AND AIR CONDITIONING II

Developed by

Harvey Warrington, Kosciusko-Attala County Vocational Center
Thomas Tourne', Canton Vocational Center
Donnie Wigginton, Tishomingo County Vocational Center
Stephen Buckheister, Jackson County Vocational Center

HEATING AND AIR CONDITIONING II

Unit No.	Title
1	Orientation
2	Safety
3	Electric Circuits and Controls, Part 1
4	Electric Circuits and Controls, Part 2
5	Domestic Refrigeration and Freezers
6	Commercial Systems
7	Commercial Condensers
8	Commercial Evaporators, Part 1
9	Commercial Evaporators, Part 2
10	Commercial Motor Controls

COURSE: Heating and Air Conditioning II

Unit 1: Orientation

Objectives: Upon completion of this unit, the student will:

*1. Identify school policy relating to students.
*2. Identify class rules relating to students.
*3. List advantages of participating in VICA.
4. Describe the history and development of air conditioning and refrigeration.
*5. List jobs available in the heating and air conditioning field.
*6. Define terms related to heating and air conditioning.

*Indicates core/essential objectives

Suggested Instructional Procedures:

Lecture - discussion

Suggested Resources:

Primary Source: Andrew, D.A., Turnquist, C.H., and Bracciano, A.F. Modern Refrigeration and Air Conditioning. South Holland, IL: The Goodheart-Willcox Company, Inc. 1982.

Secondary Source: Wantiez, G.W. Air Conditioning and Refrigeration Fundamentals. Stillwater, OK: Mid-America Vocational Consortium. 1984.

Evaluation and Suggested Minimum Performance Standards:

*Objective 1: The student will identify all school policy relating to students.
*Objective 2: The student will identify ten class rules relating to students.
*Objective 3: The student will list five advantages of participating in VICA.
Objective 4: The student will describe the history and development of air conditioning and refrigeration.
*Objective 5: The student will list four jobs available in the heating and air conditioning field.
*Objective 6: The student will define ten terms related to heating and air conditioning.

*Indicates core/essential objectives

Performance Record: Place a check by each objective the student achieved:

____*1. Identified school policy relating to students.
____*2. Identified class rules relating to students.
____*3. Listed advantages of participating in VICA.
____ 4. Described the history and development of air conditioning and refrigeration.
____*5. Listed jobs available in the heating and air conditioning field.
____*6. Defined terms related to heating and air conditioning.

*Indicates core/essential objectives

COURSE: Heating and Air Conditioning II

Unit 2: Safety

Objectives: Upon completion of this unit, the student will:

*1. Protect eyes while in the shop.
2. Name characteristics of a clean shop.
*3. Demonstrate rules of general shop safety.
4. Describe types of fires.
*5. List steps to follow in case of an accident in the shop.
*6. Explain proper method of lifting heavy objects.
7. Identify components of the fire triangle.
*8. List safety rules to follow when using an acetylene and oxyacetylene torch.
*9. List electrical safety rules.
10. Name major causes of electrical accidents.
11. Describe rescue procedures in case of electrical accidents.
*12. Demonstrate safety rules while disconnecting electrical wiring from within the electrical unit.

*Indicates core/essential objectives

Suggested Instructional Procedures:

Lecture - discussion
Laboratory participation

Suggested Resources:

Primary Source: Andrew, D.A., Turnquist, C.H., and Bracciano, A.F. Modern Refrigeration and Air Conditioning. South Holland, IL: The Goodheart-Willcox Company, Inc. 1982.

Secondary Source: Wantiez, G.W. Air Conditioning and Refrigeration Fundamentals. Stillwater, OK: Mid-America Vocational Consortium. 1984.

Evaluation and Suggested Minimum Performance Standards:

*Objective 1: The student will protect eyes according to industry standards while in the shop.
Objective 2: The student will name four characteristics of a clean shop.
*Objective 3: The student will demonstrate rules of general shop safety as taught by the instructor.
Objective 4: The student will describe three types of fires.

*Objective 5: The student will list four steps to follow in case of an accident in the shop.

*Objective 6: The student will explain one proper method of lifting heavy objects.

Objective 7: The student will identify two components of the fire triangle.

*Objective 8: The student will list four safety rules to follow when using an acetylene and oxyacetylene torch.

*Objective 9: The student will list four electrical safety rules.

Objective 10: The student will name two major causes of electrical accidents.

Objective 11: The student will describe three rescue procedures in case of electrical accidents.

*Objective 12: The student will demonstrate safety rules while disconnecting electrical wiring from within the electrical unit.

*Indicates core/essential objectives

Performance Record: Place a check by each objective the student achieved:

____ *1. Protected eyes while in the shop.
____ 2. Named characteristics of a clean shop.
____ *3. Demonstrated rules of general shop safety.
____ 4. Described types of fires.
____ *5. Listed steps to follow in case of an accident in the shop.
____ *6. Explained proper method of lifting heavy objects.
____ 7. Identified components of the fire triangle.
____ *8. Listed safety rules to follow when using an acetylene and oxyacetylene torch.
____ *9. Listed electrical safety rules.
____ 10. Named major causes of electrical accidents.
____ 11. Described rescue procedures in case of electrical accidents.
____*12. Demonstrated safety rules while disconnecting electrical wiring from within the electrical unit.

*Indicates core/essential objectives

COURSE: Heating and Air Conditioning II

Unit 3: Electric Circuits and Controls, Part 1

Objectives: Upon completion of this unit, the student will:

*1. Name types of thermostatic motor controls.
*2. List the principal operation of two thermostatic motor controls.
*3. Name reasons why thermostatic motor controls are used in the field of air conditioning.
*4. List two reasons why circuit controls are used.
*5. List types of circuit controls.
*6. Demonstrate one method of adjusting differential controls.
7. List parts of temperature and pressure control.
*8. List the proper temperature ranges for a freezer and a refrigerator.
*9. Describe how a thermostat operates in a freezer.

*Indicates core/essential objectives

Suggested Instructional Procedures:

Lecture - discussion
Laboratory participation

Suggested Resources:

Primary Source: Andrew, D.A., Turnquist, C.H., and Bracciano, A.F. Modern Refrigeration and Air Conditioning. South Holland, IL: The Goodheart-Willcox Company, Inc. 1982.

Secondary Source: Wantiez, G.W. Air Conditioning and Refrigeration Fundamentals. Stillwater, OK: Mid-America Vocational Consortium. 1984.

Miller, R. Refrigeration and Air Conditioning Technology. Peoria, IL: Bennett & McKnight Publishing Company. 1983.

Evaluation and Suggested Minimum Performance Standards:

*Objective 1: The student will name two types of thermostatic motor controls.
*Objective 2: The student will list the principal operation of two thermostatic motor controls.

*Objective 3: The student will name two reasons why thermostatic motor controls are used in the field of air conditioning.
*Objective 4: The student will list two reasons why circuit controls are used.
*Objective 5: The student will list three types of circuit controls.
*Objective 6: The student demonstrate one method of adjusting differential controls.
Objective 7: The student will list three parts of temperature and pressure control.
*Objective 8: The student will list the proper temperature ranges for a freezer and a refrigerator.
*Objective 9: The student will describe how a thermostat operates in a freezer.

*Indicates core/essential objectives

Performance Record: Place a check by each objective the student achieved:

____*1. Named types of thermostatic motor controls.
____*2. Listed the principal operation of two thermostatic motor controls.
____*3. Named reasons why thermostatic motor controls are used in the field of air conditioning.
____*4. Listed reasons why circuit controls are used.
____*5. Listed types of circuit controls.
____*6. Demonstrated one method of adjusting differential controls.
____ 7. Listed parts of temperature and pressure control.
____*8. Listed the proper temperature ranges for a freezer and a refrigerator.
____*9. Described how a thermostat operates in a freezer.

*Indicates core/essential objectives

COURSE: Heating and Air Conditioning II

Unit 4: Electric Circuits and Controls, Part 2

Objectives: Upon completion of this unit, the student will:

*1. Name the device that is used to control central air conditioning.
*2. Describe the operation of a thermostat on a central air conditioning unit.
*3. Name types of motor starting relays.
4. Describe how a current relay works.
5. Describe how a potential relay works.
*6. List two reasons why overload protection is used.
7. Locate the overload protection on an air conditioning system.
8. List types of defrost used in refrigeration.
9. Describe how an automatic defrost operates.
10. Describe how a hot gas bypass operates when it is used to defrost a refrigerator.
*11. List the major difference between the two types of defrost methods.
12. Demonstrate steps to follow when testing compressor windings with a megometer.

*Indicates core/essential objectives

Suggested Instructional Procedures:

Lecture - discussion
Laboratory participation

Suggested Resources:

Primary Source: Andrew, D.A., Turnquist, C.H., and Bracciano, A.F. Modern Refrigeration and Air Conditioning. South Holland, IL: The Goodheart-Willcox Company, Inc. 1982.

Secondary Source: Wantiez, G.W. Air Conditioning and Refrigeration Fundamentals. Stillwater, OK: Mid-America Vocational Consortium. 1984.

Miller, R. Refrigeration and Air Conditioning Technology. Peoria, IL: Bennett & McKnight Publishing Company. 1983.

Evaluation and Suggested Minimum Performance Standards:

*Objective 1: The student will name the device that is used to control central air conditioning.
*Objective 2: The student will describe the operation of a thermostat on a central air conditioning unit.
*Objective 3: The student will name two types of motor starting relays.
Objective 4: The student will describe how a current relay works.
Objective 5: The student will describe how a potential relay works.
*Objective 6: The student will list two reasons why overload protection is used.
Objective 7: The student will locate the overload protection on an air conditioning system.
Objective 8: The student will list two types of defrost used in refrigeration.
Objective 9: The student will describe how an automatic defrost operates and list two events that occur when in defrost.
Objective 10: The student will describe how a hot gas bypass operates when it is used to defrost a refrigerator.
*Objective 11: The student will list the major difference between the two types of defrost methods.
Objective 12: The student will demonstrate steps to follow when testing compressor windings with a megometer.

*Indicates core/essential objectives

Performance Record: Place a check by each objective the student achieved:

____ *1. Named the device that is used to control central air conditioning.
____ *2. Described the operation of a thermostat on a central air conditioning unit.
____ *3. Named types of motor starting relays.
____ 4. Described how a current relay works.
____ 5. Described how a potential relay works.
____ *6. Listed two reasons why overload protection is used.
____ 7. Located the overload protection on an air conditioning system.
____ 8. Listed types of defrost used in refrigeration.
____ 9. Described how an automatic defrost operates.
____ 10. Described how a hot gas bypass operates when it is used to defrost a refrigerator.
____*11. Listed the major difference between the two types of defrost methods.

____ 12. Demonstrated steps to follow when testing compressor windings with a megometer.

*Indicates core/essential objectives

COURSE: Heating and Air Conditioning II

Unit 5: Domestic Refrigeration and Freezers

Objectives: Upon completion of this unit, the student will:

*1. List reasons why domestic refrigeration is important to the preservation of food.
*2. Name types of freezers.
3. Describe the method used to insulate freezers.
4. Explain effects that insulation has on the energy efficiency of a refrigeration unit.
5. Define R, V, and K values.
*6. Calculate the R, V, and K values of six inch bat fiberglass insulation.
7. List items used during an automatic defrost cycle.
*8. Explain the cycle of an automatic defrost timer.
*9. Locate thermostat on various cooling units.
10. Explain the operation of a gas refrigeration system.
11. Charge a refrigeration system.

*Indicates core/essential objectives

Suggested Instructional Procedures:

Lecture - discussion
Laboratory participation

Suggested Resources:

Primary Source: Andrew, D.A., Turnquist, C.H., and Bracciano, A.F. Modern Refrigeration and Air Conditioning. South Holland, IL: The Goodheart-Willcox Company, Inc. 1982.

Secondary Source: Wantiez, G.W. Air Conditioning and Refrigeration Fundamentals. Stillwater, OK: Mid-America Vocational Consortium. 1984.

Miller, R. Refrigeration and Air Conditioning Technology. Peoria, IL: Bennett & McKnight Publishing Company. 1983.

Evaluation and Suggested Minimum Performance Standards:

*Objective 1: The student will list three reasons why domestic refrigeration is important to the preservation of food.

*Objective 2: The student will name two types of freezers.
Objective 3: The student will describe the method used to insulate freezers.
Objective 4: The student will explain effects that insulation has on the energy efficiency of a refrigeration unit.
Objective 5: The student will define R, V, and K values.
*Objective 6: The student will calculate the R, V, and K values of six inch bat fiberglass insulation.
Objective 7: The student will list four items used during an automatic defrost cycle.
*Objective 8: The student will explain the cycle of an automatic defrost timer.
*Objective 9: The student will locate thermostat on various cooling units.
Objective 10: The student will explain the operation of gas refrigeration system.
Objective 11: The student will charge a refrigeration system.

*Indicates core/essential objectives

Performance Record: Place a check by each objective the student achieved:

____ *1. Listed reasons why domestic refrigeration is important to the preservation of food.
____ *2. Named types of freezers.
____ 3. Described the method used to insulate freezers.
____ 4. Explained the effects that insulation has on the energy efficiency of a refrigeration unit.
____ 5. Defined R, V, and K values.
____ *6. Calculated the R, V, and K values of six inch bat fiberglass insulation.
____ 7. Listed items used during an automatic defrost cycle.
____ *8. Explained the cycle of an automatic defrost timer.
____ *9. Located thermostat on various cooling units.
____ *10. Explained the operation of a gas refrigeration system.
____ *11. Charged a refrigeration system.

*Indicates core/essential objectives

COURSE: Heating and Air Conditioning II

Unit 6: Commercial Systems

Objectives: Upon completion of this unit, the student will:

*1. List parts needed for the construction of a commercial refrigeration system.
*2. Name types of commercial compressors.
3. List characteristics of the commercial compressor.
*4. Identify components located on the high side of a refrigeration system.
*5. Identify components located on the low side of a refrigeration system.
6. Demonstrate proper safety rules while working with an ammonia system.
7. Explain the procedure for the installation of duct work on a commercial system.
8. State the direction of refrigerant flow in a heat pump in the cooling mode.
9. State the direction of refrigerant flow in a heat pump in the heating mode.
10. Explain the primary function of the reversing valve in a heat pump.
11. Describe the operation of the reversing valve in a heat pump.

*Indicates core/essential objectives

Suggested Instructional Procedures:

Lecture - discussion
Laboratory participation

Suggested Resources:

Primary Source: Andrew, D.A., Turnquist, C.H., and Bracciano, A.F. Modern Refrigeration and Air Conditioning. South Holland, IL: The Goodheart-Willcox Company, Inc. 1982.

Secondary Source: Wantiez, G.W. Air Conditioning and Refrigeration Fundamentals. Stillwater, OK: Mid-America Vocational Consortium. 1984.

Miller, R. Refrigeration and Air Conditioning Technology. Peoria, IL: Bennett & McKnight Publishing Company. 1983.

Evaluation and Suggested Minimum Performance Standards:

*Objective 1: The student will list four parts needed for the construction of a commercial refrigeration system.
*Objective 2: The student will name two types of commercial compressors.
Objective 3: The student will list four characteristics of the commercial compressor.
*Objective 4: The student will identify two components located on the high side of a refrigeration system.
*Objective 5: The student will identify two components located on the low side of a refrigeration system.
Objective 6: The student will demonstrate proper safety rules while working with an ammonia system.
Objective 7: The student will explain the procedure for the installation of duct work on a commercial system.
Objective 8: The student will state the direction of refrigerant flow in a heat pump in the cooling mode.
Objective 9: The student will state the direction of refrigerant flow in a heat pump in the heating mode.
Objective 10: The student will explain the primary function of the reversing valve in a heat pump.
Objective 11: The student will describe the operation of the reversing valve in a heat pump.

*Indicates core/essential objectives

Performance Record: Place a check by each objective the student achieved:

____ *1. Listed parts needed for the construction of a commercial refrigeration system.
____ *2. Named types of commercial compressors.
____ 3. Listed characteristics of the commercial compressor.
____ *4. Identified components located on the high side of a refrigeration system.
____ *5. Identified components located on the low side of a refrigeration system.
____ 6. Demonstrated proper safety rules while working with an ammonia system.
____ 7. Explained the procedure for the installation of duct work on a commercial system.
____ 8. Stated the direction of refrigerant flow in a heat pump in the cooling mode.
____ 9. Stated the direction of refrigerant flow in a heat pump in the heating mode.
____ 10. Explained the primary function of the reversing valve in a heat pump.

____ 11. Described the operation of the reversing valve in a heat pump.

*Indicates core/essential objectives

COURSE: Heating and Air Conditioning II

Unit 7: Commercial Condensers

Objectives: Upon completion of this unit, the student will:

*1. Name parts of an outdoor air cooled condenser.
*2. Name parts of a water cooled condenser.
*3. Describe differences between a shell and tube condenser and a shell and coil condenser.
*4. Explain functions of a tube within a tube condenser.
5. List functions of cooling towers.

*Indicates core/essential objectives

Suggested Instructional Procedures:

Lecture - discussion

Suggested Resources:

Primary Source: Andrew, D.A., Turnquist, C.H., and Bracciano, A.F. Modern Refrigeration and Air Conditioning. South Holland, IL: The Goodheart-Willcox Company, Inc. 1982.

Secondary Source: Wantiez, G.W. Air Conditioning and Refrigeration Fundamentals. Stillwater, OK: Mid-America Vocational Consortium. 1984.

Miller, R. Refrigeration and Air Conditioning Technology. Peoria, IL: Bennett & McKnight Publishing Company. 1983.

Evaluation and Suggested Minimum Performance Standards:

*Objective 1: The student will name five parts of an outdoor air cooled condenser.
*Objective 2: The student will name five parts of a water cooled condenser.
*Objective 3: The student will describe three differences between a shell and tube condenser and a shell and coil condenser.
*Objective 4: The student will explain two functions of a tube within a tube condenser.

Objective 5: The student will list two functions of cooling towers.

*Indicates core/essential objectives

Performance Record: Place a check by each objective the student achieved:

____*1. Named parts of an outdoor air cooled condenser.
____*2. Named parts of a water cooled condenser.
____*3. Described differences between a shell and tube condenser and a shell and coil condenser.
____*4. Explained functions of a tube within a tube condenser.
____ 5. Listed functions of cooling towers.

*Indicates core/essential objectives

COURSE: Heating and Air Conditioning II

Unit 8: Commercial Evaporators, Part 1

Objectives: Upon completion of this unit, the student will:

*1. List types of evaporators.
*2. Name methods used in defrosting evaporators.
*3. Describe the operation of the evaporator defrost cycle.
*4. List the average temperature with the following evaporators:
    a. frosting
    b. non-frosting
    c. forced circulation
*5. Describe evaporators and explain location.
 6. Describe the effect of humidity on commercial evaporators.

*Indicates core/essential objectives

Suggested Instructional Procedures:

Lecture - discussion

Suggested Resources:

Primary Source: Andrew, D.A., Turnquist, C.H., and Bracciano, A.F. Modern Refrigeration and Air Conditioning. South Holland, IL: The Goodheart-Willcox Company, Inc. 1982.

Secondary Source: Wantiez, G.W. Air Conditioning and Refrigeration Fundamentals. Stillwater, OK: Mid-America Vocational Consortium. 1984.

Evaluation and Suggested Minimum Performance Standards:

*Objective 1: The student will list two types of evaporators.
*Objective 2: The student will name two methods used in defrosting evaporators.
*Objective 3: The student will describe the operation of the evaporator defrost cycle.
*Objective 4: The student will list the average temperature with the following evaporators:
    a. frosting
    b. non-frosting
    c. forced circulation

*Objective 5: The student will describe three evaporators and explain location.

*Indicates core/essential objectives

Performance Record: Place a check by each objective the student achieved:

____*1. Listed types of evaporators.
____*2. Named methods used in defrosting evaporators.
____*3. Described the operation of the evaporator defrost cycle.
____*4. Listed the average temperature with the following evaporators:
  a. frosting
  b. non-frosting
  c. forced circulation
____*5. Described evaporators and explained location.

*Indicates core/essential objectives

COURSE: Heating and Air Conditioning II

Unit 9: Commercial Evaporators, Part 2

Objectives: Upon completion of this unit, the student will:

*1. List types of evaporators.
*2. List locations for liquid-cooled evaporators.
3. Describe characteristics of an immersed evaporator.
4. Describe characteristics of a pressure type evaporator.
5. List locations of a pressure type evaporator.

*Indicates core/essential objectives

Suggested Instructional Procedures:

Lecture - discussion

Suggested Resources:

Primary Source: Andrew, D.A., Turnquist, C.H., and Bracciano, A.F. Modern Refrigeration and Air Conditioning. South Holland, IL: The Goodheart-Willcox Company, Inc. 1982.

Secondary Source: Wantiez, G.W. Air Conditioning and Refrigeration Fundamentals. Stillwater, OK: Mid-America Vocational Consortium. 1984.

Evaluation and Suggested Minimum Performance Standards:

*Objective 1: The student will list two types of evaporators.
*Objective 2: The student will list two locations for liquid-cooled evaporators.
Objective 3: The student will describe two characteristics of an immersed evaporator.
Objective 4: The student will describe two characteristics of a pressure type evaporator.
Objective 5: The student will list two locations of a pressure type evaporator.

*Indicates core/essential objectives

Performance Record: Place a check by each objective the student achieved:

____*1. Listed types of evaporators.
____*2. Listed locations for liquid-cooled evaporators.

___ 3. Described characteristics of an immersed evaporator.
___ 4. Described characteristics of a pressure type evaporator.
___ 5. Listed locations of a pressure type evaporator.

*Indicates core/essential objectives

COURSE: Heating and Air Conditioning II

Unit 10: Commercial Motor Controls

Objectives: Upon completion of this unit, the student will:

*1. List types of basic motor controls used in commercial refrigeration.
*2. List characteristics of a thermostatic motor control.
*3. Name functions of a basic motor control.
*4. List characteristics of a pressure motor control.
*5. List applications of a thermostatic motor control.
*6. List applications of a pressure motor control.
*7. Describe commercial safety devices that protect the compressor.
8. Reverse rotation of a three phase motor.
9. Demonstrate the steps to follow when trouble shooting an electrical system.

*Indicates core/essential objectives

Suggested Instructional Procedures:

Lecture - discussion

Suggested Resources:

Primary Source: Andrew, D.A., Turnquist, C.H., and Bracciano, A.F. Modern Refrigeration and Air Conditioning. South Holland, IL: The Goodheart-Willcox Company, Inc. 1982.

Secondary Source: Wantiez, G.W. Air Conditioning and Refrigeration Fundamentals. Stillwater, OK: Mid-America Vocational Consortium. 1984.

Evaluation and Suggested Minimum Performance Standards:

*Objective 1: The student will list two types of basic motor controls used in commercial refrigeration.
*Objective 2: The student will list two characteristics of a thermostatic motor control.
*Objective 3: The student will name three functions of a basic motor control.
*Objective 4: The student will list two characteristics of a pressure motor control.
*Objective 5: The student will list two applications of a thermostatic motor control.

*Objective 6: The student will list two applications of a pressure motor control.

*Objective 7: The student will describe three commercial safety devices that protect the compressor.

*Indicates core/essential objectives

Performance Record: Place a check by each objective the student achieved:

____*1. Listed types of basic motor controls used in commercial refrigeration.
____*2. Listed characteristics of a thermostatic motor control.
____*3. Named functions of a basic motor control.
____*4. Listed characteristics of a pressure motor control.
____*5. Listed applications of a thermostatic motor control.
____*6. Listed applications of a pressure motor control.
____*7. Described commercial safety devices that protect the compressor.

*Indicates core/essential objectives

STUDENT PERFORMANCE RECORD

HEATING AND AIR CONDITIONING

HEATING AND AIR CONDITIONING I

Student: _____

This record is provided as an alternative to the student performance records at the end of each unit. It can be duplicated for each student and serve as a cumulative record of competencies achieved in the course.

Place a check by each objective the student achieved; you may wish to note the date that the student achieved the objective.

C = Core competencies

____ C1. Identified school policy relating to students.
____ C2. Identified class rules relating to students.
____ 3. Listed advantages of participating in VICA.
____ 4. Described the history and development of air conditioning and refrigeration.
____ C5. Listed jobs available in the heating and air conditioning field.
____ C6. Defined terms related to heating and air conditioning.
____ C7. Listed ways of protecting eyes while in the shop.
____ 8. Named characteristics of a clean shop.
____ C9. Listed rules of general shop safety.
____ C10. Described types of fires.
____ C11. Listed steps to follow in case of an accident in the shop.
____ C12. Explained proper method of lifting heavy objects.
____ C13. Identified components of the fire triangle.
____ C14. Listed safety rules to follow when using an acetylene and oxyacetylene torch.
____ 15. Listed dangers related to using refrigerant.
____ C16. Stated the purpose of a compound gauge.
____ 17. Stated the most common cause of a gauge losing calibration.
____ C18. Stated the purpose of a pressure gauge.
____ 19. Listed types of pressure gauges.
____ C20. Calibrated a gauge.
____ C21. Stated the main reason for using torque wrenches when installing gauges.
____ 22. Listed fittings to be used when connecting a compound gauge with 1/8 inch pipe male thread to a service valve having 1/4 inch female thread.
____ C23. Charged the system from the low side according to industry standards.
____ C24. Listed steps to follow when charging the system through the high side using a charging cylinder.
____ C25. Listed steps to follow when removing refrigerant from the system.

____ 26. Named special access fittings needed for the removal of a refrigerant for the system.
____C27. Installed a vacuum pump on a system in order to pump it down.
____ 28. Demonstrated steps to follow when purging and cleaning a system which had an electrical burnout.
____C29. Described the effect of freon and fluorocarbons on the atmosphere.
____C30. Demonstrated the proper extraction and disposal of freon from a refrigeration unit.
____C31. Listed types of refrigerant leak detectors.
____ 32. Demonstrated using soap bubbles as a detector.
____C33. Described the procedure for using an electronic refrigerant detector.
____C34. Listed advantages of soap bubbles.
____ 35. Listed disadvantages of soap bubbles.
____C36. Listed advantages of an electronic detector.
____ 37. Listed disadvantages of an electronic detector.
____C38. Listed advantages of a gas detector.
____C39. Listed disadvantages of a gas detector.
____C40. Named types of tubing.
____ 41. Listed sizes of copper tubing.
____C42. Identified tools needed to flare copper tubing.
____C43. Named tools used to cut copper tubing.
____ 44. Bent copper tubing.
____C45. Swaged copper tubing.
____C46. Demonstrated safety rules to observe when using an acetylene torch.
____C47. Named the steps to follow when lighting an acetylene torch.
____ 48. Named types of flux used when soldering with an acetylene torch.
____C49. Soldered two pieces of copper tubing together.
____C50. Demonstrated safety rules to observe when using an acetylene torch.
____C51. Turned off an acetylene torch.
____C52. Cleaned copper tubing for silver soldering.
____C53. Described the proper appearance of the torch flame when it is ready for use.
____ 54. Silver brazed two pieces of copper tubing together.
____C55. Listed voltage readings of meters.
____ 56. Named scales found on an ohm meter.
____ 57. Named scales found on an amp meter.
____C58. Described the functions of an ohm meter.
____C59. Described the functions of an amp meter.
____C60. Took a reading with an ohm meter.
____C61. Took a reading with an amp meter.
____C62. Took a reading with a volt meter.
____C63. Listed voltage readings of meters.

____ 64. Named scales found on an ohm meter.
____ 65. Named scales found on an amp meter.
____C66. Described the functions of an ohm meter.
____C67. Described the functions of an amp meter.
____C68. Took a reading with an ohm meter.
____C69. Took a reading with an amp meter.
____C70. Took a reading with a volt meter.

HEATING AND AIR CONDITIONING II

Student: _____

This record is provided as an alternative to the student performance records at the end of each unit. It can be duplicated for each student and serve as a cumulative record of competencies achieved in the course.

Place a check by each objective the student achieved; you may wish to note the date that the student achieved the objective.

C = Core competencies

____ C1. Identified school policy relating to students.
____ C2. Identified class rules relating to students.
____ C3. Listed advantages of participating in VICA.
____ 4. Described the history and development of air conditioning and refrigeration.
____ C5. Listed jobs available in the heating and air conditioning field.
____ C6. Defined terms related to heating and air conditioning.
____ C7. Protected eyes while in the shop.
____ 8. Named characteristics of a clean shop.
____ C9. Demonstrated rules of general shop safety.
____ 10. Described types of fires.
____C11. Listed steps to follow in case of an accident in the shop.
____C12. Explained proper method of lifting heavy objects.
____ 13. Identified components of the fire triangle.
____C14. Listed safety rules to follow when using an acetylene and oxyacetylene torch.
____C15. Listed electrical safety rules.
____ 16. Named major causes of electrical accidents.
____ 17. Described rescue procedures in case of electrical accidents.
____C18. Demonstrated safety rules while disconnecting electrical wiring from within the electrical unit.
____C19. Named types of thermostatic motor controls.
____C20. Listed the principal operation of two thermostatic motor controls.
____C21. Named reasons why thermostatic motor controls are used in the field of air conditioning.
____C22. Listed reasons why circuit controls are used.
____C23. Listed types of circuit controls.
____C24. Demonstrated one method of adjusting differential controls.
____ 25. Listed parts of temperature and pressure control.
____C26. Listed the proper temperature ranges for a freezer and a refrigerator.
____C27. Described how a thermostat operates in a freezer.

____C28. Named the device that is used to control central air conditioning.
____C29. Described the operation of a thermostat on a central air conditioning unit.
____C30. Named types of motor starting relays.
____ 31. Described how a current relay works.
____ 32. Described how a potential relay works.
____C33. Listed two reasons why overload protection is used.
____ 34. Located the overload protection on an air conditioning system.
____ 35. Listed types of defrost used in refrigeration.
____ 36. Described how an automatic defrost operates.
____ 37. Described how a hot gas bypass operates when it is used to defrost a refrigerator.
____C38. Listed the major difference between the two types of defrost methods.
____ 39. Demonstrated steps to follow when testing compressor windings with a megometer.
____C40. Listed reasons why domestic refrigeration is important to the preservation of food.
____C41. Named types of freezers.
____ 42. Described the method used to insulate freezers.
____ 43. Explained the effects that insulation has on the energy efficiency of a refrigeration unit.
____ 44. Defined R, V, and K values.
____C45. Calculated the R, V, and K values of six inch bat fiberglass insulation.
____ 46. Listed items used during an automatic defrost cycle.
____C47. Explained the cycle of an automatic defrost timer.
____C48. Located thermostat on various cooling units.
____C49. Explained the operation of a gas refrigeration system.
____C50. Charged a refrigeration system.
____C51. Listed parts needed for the construction of a commercial refrigeration system.
____C52. Named types of commercial compressors.
____ 53. Listed characteristics of the commercial compressor.
____C54. Identified components located on the high side of a refrigeration system.
____C55. Identified components located on the low side of a refrigeration system.
____ 56. Demonstrated proper safety rules while working with an ammonia system.
____ 57. Explained the procedure for the installation of duct work on a commercial system.
____ 58. Stated the direction of refrigerant flow in a heat pump in the cooling mode.
____ 59. Stated the direction of refrigerant flow in a heat pump in the heating mode.

____ 60. Explained the primary function of the reversing valve in a heat pump.
____ 61. Described the operation of the reversing valve in a heat pump.
____C62. Named parts of an outdoor air cooled condenser.
____C63. Named parts of a water cooled condenser.
____C64. Described differences between a shell and tube condenser and a shell and coil condenser.
____C65. Explained functions of a tube within a tube condenser.
____ 66. Listed functions of cooling towers.
____C67. Listed types of evaporators.
____C68. Named methods used in defrosting evaporators.
____C69. Described the operation of the evaporator defrost cycle.
____C70. Listed the average temperature with the following evaporators:
a. frosting
b. non-frosting
c. forced circulation
____C71. Described evaporators and explained location.
____C72. Listed types of evaporators.
____C73. Listed locations for liquid-cooled evaporators.
____ 74. Described characteristics of an immersed evaporator.
____ 75. Described characteristics of a pressure type evaporator.
____ 76. Listed locations of a pressure type evaporator.
____C77. Listed types of basic motor controls used in commercial refrigeration.
____C78. Listed characteristics of a thermostatic motor control.
____C79. Named functions of a basic motor control.
____C80. Listed characteristics of a pressure motor control.
____C81. Listed applications of a thermostatic motor control.
____C82. Listed applications of a pressure motor control.
____C83. Described commercial safety devices that protect the compressor.